14. (New) A method for designing a nuclear fuel assembly which is intended to be positioned in a nuclear reactor, the assembly comprising a plurality of guide tubes and a control cluster which comprises a plurality of control rods and a support for control rods, the control rods and the guide tubes extending in parallel with a longitudinal direction, each of the control rods being received in a guide tube in order to form pairs comprising guide tubes/control rods, each of the guide tubes comprising a lower damping portion which comprises at least a portion of reduced inside diameter, the portion configured to contain a fluid for damping a fall of the control rod which is received in the guide tube, the portion of reduced inside diameter surrounding the control rod with a radial passage gap (J) when the control rod is introduced in the guide tube wherein for at least one pair comprising a guide tube/control rod, the method comprising:

establishing a falling speed of the control rod upon entry into the lower damping portion when the control cluster falls in an event of a shutdown of the nuclear reactor;

establishing, based on the falling speed, a progression of the falling speed of the control rod in the lower damping portion;

establishing, based on the progression of the falling speed of the control rod in the lower damping portion, a maximum elevated pressure (ΔP_{MAX}) produced in the fluid contained in the lower damping portion; and

establishing, based on the maximum elevated pressure (ΔP_{MAX}), a maximum circumferential stress ($\sigma_{\theta MAX}$) produced in the lower damping portion.

15. (New) The method according to claim 14, further comprising:

verifying, using the maximum circumferential stress, that a maximum stress admissible by the guide tube has not been exceeded.

16. (New) The method according to claim 14, wherein the establishing, based on the falling speed, of a progression of the falling speed of the control rod in the lower damping portion, is performed using a higher value for the radial passage gap (J) and the step of establishing, based on the progression of the falling speed of the control rod in the lower damping portion, a maximum elevated pressure (ΔP_{MAX}) produced in the liquid contained in the lower damping portion is performed using a lower value for the radial passage gap (J).

17. (New) The method according to claim 16, wherein the higher value is a maximum statistical value for the passage gap (J).

18. (New) The method according to claim 16, wherein the lower value is a minimum statistical value for the passage gap (J).

19. (New) The method according to claim 14, wherein the support of the control cluster comprises a helical spring for damping an impact of the support against an upper end piece of the assembly in an event of the control cluster falling during a shutdown of the reactor, the method further comprising:

establishing the progression of the speed of the control cluster after the impact of the support against the upper end piece,

establishing, based on the progression of the speed of the control cluster after the impact of the support against the upper end piece, a maximum longitudinal load for compression of the spring; and

establishing, based on the maximum longitudinal load for compression, at least a maximum shearing stress in the spring.

20. (New) The method according to claim 19, wherein the maximum shearing stress is a shearing stress along a neutral axis (FN) of the spring.

21. (New) The method according to claim 20, wherein the maximum shearing stress is a shearing stress along an axis (F2) of the spring nearest the longitudinal center axis (A) thereof.

22. (New) The method according to claim 19, further comprising:

verifying, using the maximum shearing stress in the spring, that a maximum stress admissible by the spring has not been exceeded.

23. (New) A system for designing a nuclear fuel assembly, comprising:

an arrangement for establishing a falling speed of a control rod upon entry into a lower damping portion when a control cluster falls in an event of a shutdown of a nuclear reactor;

establishing, based on the falling speed, a progression of the falling speed of the control rod in the lower damping portion;

establishing, based on the progression of the falling speed of the control rod in the lower damping portion, a maximum elevated pressure (ΔP_{MAX}) produced in a liquid contained in the lower damping portion; and

establishing, based on the maximum elevated pressure (ΔP_{MAX}) , a maximum circumferential stress ($\sigma_{\theta MAX}$) produced in the lower damping portion.

24. (New) The system according to claim 23, wherein the arrangement comprises a computer arrangement and a storage arrangement in which at least a program comprising instructions for performing the method steps for designing the nuclear fuel assembly is stored.

25. (New) An article of manufacture, comprising:

an arrangement containing instructions to establish a falling speed of a control rod upon entry into a lower damping portion when a control cluster falls in an event of a shutdown of a nuclear reactor, establish, based on the falling speed, a progression of the falling speed of the control rod in the lower damping portion, establishing, based on the progression of the falling speed of the control rod in the lower damping portion, a maximum elevated pressure (ΔP_{MAX}) produced in a liquid contained in the lower damping portion, and establishing, based on the maximum elevated pressure (ΔP_{MAX}) , a maximum circumferential stress ($\sigma_{\theta MAX}$) produced in the lower damping portion the article of manufacture configured to be read by a computer.